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## **Determination of optimal conditions of complete feed block production based on alfalfa and wheat straw in dairy cattle nutrition**

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### **Abstract**

This study was carried out in two experiments to determine the optimal conditions for production of complete feed blocks (CFBs) and to assessment of the effect of CFBs intake on lactating cow performance. The first experiment was conducted to determine the effects of two pressure levels in the hydraulic press (200 and 220 bar) of CFBs manufacturing machine, three levels of the pressure dwell time (5, 17 and 30 seconds) and two levels of 2.68 (short) and 4.15 (long) millimeters (mm) of forage particle size geometric mean on durability and compressibility characteristics of CFBs in a completely randomized design with 12 treatments and 10 replications. The most of the Post Compression Expansion (PCE) and the density reduction of CFBs occurred in the first 24 hours post production ( $P < 0.01$ ). CFBs with long and short particles with presses pressure of 220 bar and dwell time of 17 sec had higher durability, and they also had minimum and maximum of particles abscission, respectively ( $P < 0.05$ ). With increasing the hydraulic pressure, increased ( $P < 0.05$ ) the evaporation percent of moisture of CFBs containing long forage particles, resulted in the non-proliferation of mold colonies in the CFBs after 35 days of storage ( $P > 0.05$ ); but CFBs containing short forage particles decreased corresponding parameter hence the number of visible mold colonies increased ( $P < 0.05$ ). The results of the first experiment showed that geometric mean of forage particle size between 2.68 and 4.15 mm, hydraulic press pressure of 220 bar and pressure dwell time for 5 seconds were the best conditions for the production of alfalfa and wheat straw-based CFBs. In the second experiment, effect of four experimental diets included CFBs containing alfalfa and wheat straw with a geometric mean of 4.15mm (long), CFBs containing alfalfa and wheat straw with a geometric mean of 2.68mm (short), mash complete feed (mash) containing long alfalfa and wheat straw and mash containing short alfalfa and wheat straw on feeding behavior, nutrients digestibility and production efficiency were investigated in Holstein dairy cows. Compression of the complete diet led to increasing the length (minute per day) and the extent (kg dry matter) of each meal by 18.42% and 21.21%, respectively, reducing the number of meals by 16.41% and increasing the rate of eating (kg dry matter per minute) by 10.79% ( $P < 0.05$ ). On the other hand, increasing the forage particle size also increased the length of each meal and reduced the rate of eating by 25.55% and 20.00%, respectively ( $P < 0.05$ ), but did not affect the number and size of the meals. Effects of compression of complete rations on spent times for eating, ruminating and total chewing time (minutes per day or minute per kg of dry matter

intake) were not significant, but an increase in geometric mean of forage particle size increased these parameters ( $P < 0.05$ ). Dry and organic matter intake in lactating cows fed short forage particle size CFBs were greater than cows fed short forage particle size mash ( $P < 0.05$ ), but the difference between in dry matter intake of these two groups with other groups was not significant. The results of this experiment indicated a positive effect of reducing of forage particle size from a mean geometric value of 4.15 mm to 2.68 mm on the digestibility of dietary nutrients and the ineffectiveness of compression of a forage-concentrate compound in the form of a complete feed block in digestibility of dietary nutrition. Daily milk yield (kg) of raw milk in lactating cows fed short forage particle size CFBs were about two percent higher than other lactating cows ( $P < 0.05$ ), but the comparison of the means was not significant by converting raw milk into a corrected milk based on four percent fat or milk adjusted for energy. The use of CFBs resulted in a decrease of 2.21% in daily production (kg) of milk fat ( $P = 0.006$ ). Differences in the feed efficiency means between groups of dairy cows were not significant. It is recommended that the consumption of CFBs be limited to the fattening animals, as well as to the native and hybrid cows kept in traditional or semi-industrial conditions.

**Keywords:** Compressibility, Forage particle size, Physical form of the feed, Production efficiency.